



SCORING METHODOLOGY

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HOSPITAL SAFETY SCORESM

2012 Scoring Methodology

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What is the Hospital Safety ScoreSM?

The nation's healthcare system is undergoing rapid and dramatic change. There is now a cacophony of data and information in the public domain about hospital performance, but few healthcare consumers can interpret its significance.

The Hospital Safety Score grades general hospitals on how safe they are for patients. The score includes data that patient safety experts use to compare hospitals. Publicly available data from the Centers for Medicare and Medicaid, The Leapfrog Hospital Survey, and secondary data sources are weighted and then combined to produce a single, consumer-friendly composite score that will be published as a letter grade.

With the Hospital Safety Score, The Leapfrog Group aims to educate and to encourage consumers to consider safety when selecting a hospital for themselves or their families. In addition, we believe the score will foster strong market incentives for hospitals to make safety a priority.

Who is the Leapfrog Group?

The Leapfrog Group (www.leapfroggroup.org) is a national not-for-profit organization that was founded over a decade ago by the nation's leading employers and private healthcare purchasers. The organization strives to make giant "leaps" forward in the safety, quality, and affordability of healthcare in the U.S. by promoting transparency and value-based hospital incentives. To that end, Leapfrog has focused on measuring and publicly reporting on hospital performance through the annual Leapfrog Hospital Survey. The survey is a trusted, transparent, and evidence-based national tool that more than 1100 hospitals voluntarily participate in free of charge. For more information on The Leapfrog Hospital Survey visit <http://leapfroghospitalsurvey.org/>.

Eligible and Excluded Hospitals

The Leapfrog Group calculated a Hospital Safety Score for 2,652 hospitals for which there was sufficient publicly available data. Because publicly available data is limited for a variety of reasons, Leapfrog is not able to calculate a score for every hospital in the U.S.

The following types of hospitals were not assigned safety scores:

- Critical access hospitals (CAH)
- Long-term care facilities
- Mental health facilities
- Federal hospitals (e.g., Veterans Affairs, Indian Health Services, etc.)

- Specialty hospitals, including surgical centers and cancer hospitals
- Pediatric Hospitals
- Hospitals in U.S. territories
- Maryland hospitals, as they do not participate in the Center for Medicare and Medicaid Services' (CMS) Inpatient Prospective Payment System (IPPS)
- Hospitals that are missing **more than 9** process/structural measures and **more than 3** outcome measures

Information for Hospitals that Share a Medicare Provider Number with another Hospital

All facilities that share a Medicare Provider Number (MPN) will be assigned the same source data as reported on CMS Hospital Compare. Affected measures include the SCIP process measures, Hospital Acquired Condition's, PSI's, and CLABSI when applicable.

Scoring Methodology

The Hospital Safety Score utilizes national performance measures from the Leapfrog Hospital Survey, the Agency for Healthcare Research and Quality (AHRQ), the Centers for Disease Control and Prevention (CDC), and the Centers for Medicare and Medicaid Services (CMS) to produce a single composite score that represents a hospital's overall performance in keeping patients safe from preventable harm and medical errors. In addition, secondary data from the American Hospital Association's Annual Survey was used to give hospitals as much credit as possible towards their safety scores. The Hospital Safety Score includes 26 measures, which are all currently in use by national measurement and reporting programs. The measure set is divided into two domains: (1) Process/Structural Measures and (2) Outcome Measures. Each domain represents 50% of the Hospital Safety Score.

For Process/Structural Measures, a higher score is always better because these are measures of compliance with best practices in patient care (e.g., SCIP-INF-1: Prophylactic antibiotic received within 1-hour prior to surgical incision). For Outcome Measures, a lower score is always better because these are measures of the incidence of adverse events for patients (e.g., Foreign Objects Left after Surgery).

This document describes, in detail and through examples, how a hospital's Safety Score is calculated. Hospitals and others can use this document to verify Hospital Safety Score calculations. If you have additional questions about the scoring methodology or the Hospital Safety Score, please contact scorehelp@leapfroggroup.org.

Measures

The following table lists the 26 measures included in the Hospital Safety Score, and the source of hospitals' performance information for each measure. In some cases where a hospital's information is not available for a certain measure, Leapfrog uses a secondary data source (as indicated in the table). In cases where a hospital's information is not available from any data source, Leapfrog has outlined a methodology for dealing with the missing data. This methodology is described later in the document, in the [Dealing with Missing Data](#) section.

Measure Name	Primary Data Source	Secondary Data Source
Process and Structural Measures (15)		
Computerized Physician Order Entry (CPOE)	Leapfrog Hospital Survey	AHA Annual Survey
ICU Physician Staffing (IPS)	Leapfrog Hospital Survey	AHA Annual Survey
Safe Practice 1: Leadership Structures and Systems	Leapfrog Hospital Survey	
Safe Practice 2: Culture Measurement, Feedback and Intervention	Leapfrog Hospital Survey	
Safe Practice 3: Teamwork Training and Skill Building	Leapfrog Hospital Survey	
Safe Practice 4: Identification and Mitigation of Risks and Hazards	Leapfrog Hospital Survey	
Safe Practice 9: Nursing Workforce	Leapfrog Hospital Survey	
Safe Practice 17: Medication Reconciliation	Leapfrog Hospital Survey	
Safe Practice 19: Hand Hygiene	Leapfrog Hospital Survey	
Safe Practice 23: Care of the Ventilated Patient	Leapfrog Hospital Survey	
SCIP INF 1: Antibiotic within 1 Hour	CMS Hospital Compare	
SCIP INF 2: Antibiotic Selection	CMS Hospital Compare	
SCIP INF 3: Antibiotic Discontinued After 24 Hours	CMS Hospital Compare	
SCIP INF 9: Catheter Removal	CMS Hospital Compare	
SCIP VTE 2: VTE Prophylaxis	CMS Hospital Compare	
Outcome Measures (11)		
Foreign Object Retained	CMS Hospital Compare	
Air Embolism	CMS Hospital Compare	
Pressure Ulcer – Stages 3 and 4	CMS Hospital Compare	
Falls and Trauma	CMS Hospital Compare	
CLABSI	Leapfrog Hospital Survey	CMS Hospital Compare
PSI 4: Death Among Surgical Inpatients	CMS Hospital Compare	
PSI 6: Iatrogenic Pneumothorax	CMS Hospital Compare	

PSI 11: Postoperative Respiratory Failure	CMS Hospital Compare	
PSI 12: Postoperative PE/DVT	CMS Hospital Compare	
PSI 14: Postoperative Wound Dehiscence	CMS Hospital Compare	
PSI 15: Accidental Puncture or Laceration	CMS Hospital Compare	

Overview of Hospital Safety Score Measures and Scoring Considerations

Each of the 26 measures included in the Hospital Safety Score is either a process, structural or outcome measure. The Hospital Safety Score places each measure into two (2) domains: (1) Process/Structural Measures and (2) Outcome Measures. Each domain is weighted at 50% of the overall Hospital Safety Score.

Process Measures. A process measure is one that measures how often a hospital gives patients a recommended treatment for a given medical condition or procedure.¹ For example, SCIP-INF-1 measures how often a hospital adheres to the process of giving patients an antibiotic within one (1) hour prior to surgical incision.

Structural Measures. A structural measure is one that measures the environment in which patients receive care. For example, CPOE is a structural measure.¹ CPOE measures whether or not a hospital uses a computerized physician order entry system to prevent medication errors.

Outcome Measures. An outcome measure is one that measures what happened to a patient while they were receiving care.¹ For example, Foreign Object Retained after Surgery measures how many times a patient undergoing surgery had a foreign object left in his or her body.

Each of the 26 measures, whether it is a process, structural or outcome measure, is classified as either categorical or continuous, depending on how the measure is scored by the source of the data (e.g. for the SCIP measures, CMS Hospital Compare is the data source).

Categorical Measures. A categorical measure is one that measures a hospital's performance by performance categories or by categorical statements. Computerized Physician Order Entry (CPOE) is an example of a categorical measure. A hospital's performance is reported in the following way: "fully meets the standard," "substantial progress," "some progress," "willing to report," or "declined to report." These performance categories correspond to a hospital's ability to meet the CPOE standard. (See examples at www.leapfroggroup.org/cp) For the Hospital Safety Score Methodology, these performance categories (e.g., "fully meets the standard," "substantial progress," etc.) are converted

¹ U.S. Department of Health and Human Services. *Hospital Quality Overview*. <http://www.hospitalcompare.hhs.gov/staticpages/for-consumers/for-consumers.aspx>

into numerical values so the measure can be scored and included in the overall Hospital Safety Score. The following image depicts a categorical scale, with the diamond representing a hospital's potential score on a categorical measure. You can see that a hospital can only fall into one (1) of the five (5) categories, and cannot fall in between the categories.



Continuous Measures. A continuous measure is one that measures a hospital's performance by a counting process or by an interval continuum. A score on a continuous measure can assume an infinite number of values. The SCIP measures are examples of continuous measures. A hospital's rates for this measure may fall anywhere along a continuum between 0 and 100 (e.g., 97, 98.4, etc.). The following image depicts a continuous scale, with the diamonds representing two potential scores a hospital could receive on a continuous measure:



“Not Applicable” Results. If a measure is not applicable for a hospital, it is indicated by “N/A.” For example, if a hospital does not have an ICU, it will receive a score of “N/A” on the ICU Physician Staffing measure. When hospitals are not applicable for a measure, the score for that measure is not included in either the numerator or denominator of the overall score. As a result, the remainder of a hospital's applicable measures will receive slightly higher weights, because the weights from the non-applicable measures are allocated across the applicable measures.

Not Available Results. If publicly available data is not available for a given measure, it is indicated as “Not Available.” For example, if a hospital did not report on its progress in implementing the Safe Practices, it will receive a score of “Not Available” on the Safe Practice measures. When data is not available for a measure, the score for that measure is not included in either the numerator or denominator of the overall score. As a result, the remainder of a hospital's applicable measures will receive slightly higher weights, because the weights from measures in which data was not available are allocated across the other measures.

Measure Descriptions

Process/Structural Measures

The following measures are classified as Process/Structural Measures in the Hospital Safety Score. For Process/Structural Measures, a higher score is always better because these are measures of compliance with best practices in patient care (e.g., SCIP-INF-1: Prophylactic antibiotic received within 1-hour prior to surgical incision).

Computerized Physician Order Entry (CPOE). The CPOE measure is collected by The Leapfrog Group on the Leapfrog Hospital Survey. It measures a hospital's progress toward implementing a CPOE system and the efficacy of that system in alerting prescribers to common medication errors such as drug-drug interactions and drug-allergy interaction. CPOE systems can reduce medication errors by up to 88%. CPOE is a categorical measure—hospitals receive either “fully meets standard,” “substantial progress,” “some progress,” “willing to report,” or “declined to report” based on their reported data. A numerical score is assigned to each performance category in the following way:

- “Fully meets standard” = 100 points
- “Substantial progress” = 50 points
- “Some progress” = 15 points
- “Willing to report” = 5 points
- “Declined to report” = 0 points

This Scoring Methodology translates a hospital's CPOE score (e.g., 100, 50, 15, 5, or 0) into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by 7.7% and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. Please note that this standard weight may differ if your hospital is not applicable for other Process/Structural Measures.

Please see the [Dealing with Missing Data](#) section for detailed information on assigning a CPOE score to hospitals using the AHA annual survey as a secondary data source.

ICU Physician Staffing (IPS). The IPS measure is collected by The Leapfrog Group on the Leapfrog Hospital Survey. It measures a hospital's intensivist coverage in ICU's, which significantly reduces mortality rates when implemented. IPS is a categorical measure—hospitals receive either “fully meets standards,” “substantial progress,” “some progress,” “willing to report,” or “declined to report” based on their reported data. A numerical score is assigned to each level of achievement in the following way:

- “Fully meets” = 100 points

- “Substantial progress” = 50 points
- “Some progress” = 15 points
- “Willing to report” = 5 points
- “Declined to report” = 0 points

IPS is a Process/Structural Measure and receives 7.5% of the total Safety Score. This Scoring Methodology translates a hospital’s score (from above) into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by 7.2% and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. Please note that this standard weight may differ if your hospital is not applicable for other Process/Structural Measures.

Please see the [Dealing with Missing Data](#) section for detailed information on assigning an IPS score to hospitals using the AHA annual survey as a secondary data source.

NQF Safe Practices. NQF Safe Practices measure a hospital’s progress in implementing processes and protocols that promote safe patient care. Information about hospitals’ progress in implementing these practices and protocols is collected by The Leapfrog Group on the Leapfrog Hospital Survey. The Hospital Safety Score contains eight (8) NQF Safe Practice measures that are classified as Process/Structural Measures in the Scoring Methodology. This Scoring Methodology translates a hospital’s score on each Safe Practice into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by the standard safe practice weight, and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. The following Safe Practices are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Process/Structural Measures.

Safe Practice	Weight
SP 1: Leadership Structures and Systems	2.3%
SP 2: Culture Measurement, Feedback and Intervention	2.5%
SP 3: Teamwork Training and Skill Building	2.6%
SP 4: Identification and Mitigation of Risks and Hazards	2.4%
SP 9: Nursing Workforce	3.3%
SP 17: Medication Reconciliation	2.4%
SP 19: Hand Hygiene	3.1%
SP 23: Care of the Ventilated Patient	2.4%

Please see the [Dealing with Missing Data](#) section for detailed information on assigning a Safe Practices score to hospitals that do not report to Leapfrog.

Surgical Care Improvement Project (SCIP) Measures. The Hospital Safety Score includes five (5) SCIP measures that are classified as Process/Structural measures in the Scoring Methodology. Hospitals can report on their progress on these measures through CMS' Hospital Quality Reporting Program. The SCIP measures are all reported as a percentage on a scale from 0% to 100%. This Scoring Methodology translates a hospital's score on each SCIP measure into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by a standard weight, and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. The following SCIP process measures are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Process/Structural Measures.

SCIP Measure	Weight
SCIP-INF-1: Prophylactic antibiotic received within 1-hour prior to surgical incision	2.9%
SCIP-INF-2: Prophylactic antibiotic selection for surgical patients	2.2%
SCIP-INF-3: Prophylactic antibiotics discontinued within 24 hours after surgery end time	2.2%
SCIP-INF-9: Urinary catheter removed on postoperative day 1 or 2	3.0%
SCIP-VTE-2: Surgery patients who received appropriate venous thromboembolism (VTE) prophylaxis within 24 hours prior to surgery to 24 hours after surgery	3.7%

Outcome Measures

The following measures are classified as Outcome Measures in the Hospital Safety Score. For Outcome Measures, a lower score is always better because these are measures of the incidence of adverse events for patients (e.g., Foreign Object Retained After Surgery).

Central-Line Associated Bloodstream Infection (CLABSI) Rates. CLABSI is a measure that assesses a hospital's level of performance for minimizing this hospital-acquired infection (HAI) in ICUs. The score for this measure is based on the hospital's [Standardized Infection Ratio \(SIR\)](#) for CLABSI. A SIR is identical in concept to a standardized mortality ratio, and can be used as an indirect standardization method for summarizing HAI experience across any number of stratified groups of data.

CLABSI is an outcome measure and receives a weight of 6.4% of the total Safety Score. This Scoring Methodology translates a hospital's CLABSI SIR into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by 6.4%, and adds this calculation to the remaining Outcome Measures to derive the Outcome Score. Please note that this standard weight may differ if your hospital is not applicable for other Outcome Measures.

Please see the [Dealing with Missing Data](#) section for detailed information on assigning a CLABSI score to hospitals using the CMS Hospital Compare database as a secondary data source.

Hospital Acquired Conditions (HACs). The Hospital Safety Score contains four (4) measures of Hospital Acquired Conditions that are classified as Outcome measures in the Scoring Methodology. Hospitals can report on their progress on these measures through CMS' Hospital Quality Reporting Program. The HAC measures are reported as a rate per 1,000 discharges. This Scoring Methodology translates a hospital's score on each of the HAC measures into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by the standard weight, and adds this calculation to the remaining Outcome Measures to derive the Outcome Score. The following HAC measures are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Outcome measures.

HAC Measure	Weight
Foreign Object Retained After Surgery	5.6%
Air Embolism	5.6%
Stage III and IV Pressure Ulcers	7.4%
Falls and Trauma	6.0%

AHRQ Patient Safety Indicators (PSIs). The Hospital Safety Score contains six (6) Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators that are classified as Outcome measures in the Scoring Methodology. Hospitals can report on their progress on these measures through CMS' Hospital Quality Reporting Program. The PSIs are reported as a rate per 1,000 patient discharges. This Scoring Methodology translates a hospital's score on each AHRQ PSI into a Z-Score (see [Calculating Z-Scores](#) for more information), then multiplies the Z-Score by the standard weight, and adds this calculation to the remaining Outcome Measures to derive the Outcome Score. The following PSIs are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Outcome measures.

AHRQ PSIs	Weight
PSI 4: Death among Surgical Inpatients with Serious Treatable Complications	2.7%
PSI 6: Iatrogenic Pneumothorax	3.1%
PSI 11: Postoperative Respiratory Failure	3.0%
PSI 12: Postoperative Pulmonary Embolism (PE) or Deep Vein Thrombosis (DVT)	3.2%
PSI 14: Postoperative Wound Dehiscence	2.7%
PSI 15: Accidental Puncture or Laceration	4.3%

Using Secondary Data Sources and Dealing with Missing Data

Eleven (11) of the 26 measures that make up the Hospital Safety Score are derived from hospitals' responses to the Leapfrog Hospital Survey. However, the Leapfrog Hospital Survey is voluntary, and many hospitals decline to report. Therefore, a methodology for addressing missing Leapfrog data was developed in order to allow scoring of all hospitals in the country, including those that did not report to Leapfrog's annual survey. This section describes the methods developed for using secondary data sources and dealing with missing data. For information on how to complete a free Leapfrog Hospital Survey, visit www.leapfroghospitalsurvey.org.

Computerized Physician Order Entry (CPOE)

The method developed to score CPOE utilizes data from the AHA Annual Survey as a secondary data source for dealing with missing Leapfrog values on this measure. The following rules apply:

1. When Leapfrog Hospital Survey data is the **primary data source** for CPOE:
 - a. If a hospital was scored by Leapfrog through the Leapfrog Hospital Survey, use the survey performance category score described previously (e.g., "willing to report," "some progress," "substantial progress," or "fully meets standard").
 - b. If a hospital was scored by Leapfrog through the Leapfrog Hospital survey as "Response not Required," the hospital receives N/A.
 - c. If a hospital was scored by Leapfrog through the Leapfrog Hospital survey as "Not Applicable," the hospital receives N/A.
 - d. If a hospital was scored by Leapfrog through the Leapfrog Hospital Survey as "Declined to Respond," go to secondary data source.
2. When using data from the AHA Annual Survey as a **secondary data source** for CPOE:
 - a. If a hospital in the AHA data set received a value of 1 ("fully implemented all units") on the measure *Reported CPOE Implementation Level for Medications*, they receive a categorical score of "Some progress", or 15 points.
 - b. If a hospital in the AHA data set received a value of 2 ("fully implemented at least 1 unit") or 3 ("beginning to implement at least 1 unit") on the measure *Reported CPOE Implementation Level for Medications*, they receive a categorical score of "Willing to report", or 5 points.
 - c. If a hospital in the AHA data set received a value of 3, 4, 5, or 6, a score of 0 is applied.
 - d. If a hospital is not in the AHA data set and is not located in a rural county, a score of 0 is applied.
 - e. If a hospital is not in the AHA data set and is located in a rural county, a score of N/A is applied.*

ICU Physician Staffing (IPS)

The method developed to score IPS utilizes data from the AHA Annual Survey as a secondary data source for dealing with missing values on this measure. The following rules apply:

1. When Leapfrog Hospital Survey data is the **primary data source** for IPS:
 - a. If a hospital reported to the Leapfrog Hospital Survey, use the survey performance category score described previously (e.g., “fully meets standard” = 100 points, etc.).
 - b. If a hospital reported “Response not Required,” treat this hospital as N/A as this is a rural hospital for which IPS standards do not apply.*
 - c. If a hospital reported “Not Applicable”, then treat this hospital as N/A.
 - d. If a hospital reported “Declined to Respond”, use the secondary data source.

2. When using AHA data as a **secondary source** for IPS:
 - a. If a hospital is not located in a rural county and it does not have any ICU beds, then treat it as N/A (ICU bed number can be found in the data from the AHA Annual Survey).
 - b. If a hospital in the AHA data set reported “yes” on *Closed Med/Surg ICU Reported* **and** reported a FTE > 0 on *Reported FTE # Intensivists Med/Surg ICU*, **and/or** reported “yes” on *Closed Pediatric ICU Reported* **and** reported a FTE > 0 on *Reported FTE # Intensivists Pediatric ICU*, they receive a categorical score of “Some progress”, or 15 points.
 - c. If a hospital in the AHA data set did not report reported a FTE > 0 on *Reported FTE # Intensivists Med/Surg ICU*, **and/or** reported a FTE > 0 on *Reported FTE # Intensivists Pediatric ICU*, they receive a categorical score of “Willing to report”, or 5 points.
 - d. If a hospital is not in the AHA data set and is not located in a rural county, a score of 0 is applied.
 - e. If a hospital is not in the AHA data set and is located in a rural county, a score of N/A is applied.*

*Hospitals are scored differently on CPOE and IPS based on their status as rural or urban. Leapfrog has developed the following methodology for identifying if a hospital is rural or urban:

1. If a hospital reports to Leapfrog, use the designation of rural or urban included in the Leapfrog database.
2. If a hospital does not report to Leapfrog, use the designation of rural or urban included in the AHA database.
3. If a hospital does not have a designation of rural or urban in either the Leapfrog or AHA databases, Leapfrog assumes the hospital is urban.

Central-Line Associated Bloodstream Infection (CLABSI) Rates

The method developed to score CLABSI utilizes data from the CMS Hospital Compare database as a secondary data source for dealing with missing values on this measure. The following rules apply:

1. If a hospital in the CMS Hospital Compare data set reported N/A on CLABSI SIR and noted it was because the hospital does not have ICU locations, the hospital is treated as N/A.
2. If a hospital in the CMS data set reported N/A on CLABSI SIR and noted it was due to small case size, the hospital is treated as N/A.
3. If the two above criteria are not met, the hospital's CLABSI SIR reported in the CMS data set is assigned.

NQF Safe Practices

The method developed to score the NQF Safe Practices does not use a secondary data source for dealing with missing data. The following rules apply:

1. Non-Leapfrog Hospital Survey reporting hospitals will receive a score of "Not Available" on the Safe Practice measures.
2. All Leapfrog Hospital Survey reporting hospitals' Safe Practices scores are assigned.

A note about extreme values in the data set

For hospitals that reported an extreme value for a particulate measure, a value that exceeded the 99th percentile, Leapfrog replaced the reported value with that of the 99th percentile. This is indicated in the source data with an asterisk (*).

Weighting Individual Measures

Each individual measure included in the Hospital Safety Score is assigned a weight. The weighting methodology includes three criteria for weighting each measure that reflect the quality of the measure. These criteria are: (1) Impact, (2) Evidence, and (3) Opportunity. These three (3) criteria are then combined using the following equation to compute a relative importance score for each measure: **[Evidence + (Opportunity x Impact)]**. The score computed from this calculation is then used to calculate an overall weight for each measure.

Evidence

The Evidence Score for each individual measure is assigned a value of one (1) or two (2) using the following criteria:

- 1 = Supported by either suggestive clinical or epidemiological studies or theoretical rationale
- 2 = Supported by experimental, clinical, or epidemiological studies and strong theoretical rationale

Opportunity

The Opportunity Score for each individual measure is based on the Coefficient of Variation (Standard Deviation/Mean) of that measure, using the following formula: **[1 + (Standard Deviation/Mean)]**. The Opportunity Score is on a continuous scale that is capped at three (3). Any measure with an Opportunity Score above three (3) is assigned a three (3).

Impact

The Impact Score for each individual measure is comprised of two (2) parts, each of which is assigned a value from one (1) to three (3):

1. Number of patients affected
2. Severity of harm

The *number of patients affected* score is determined by the following:

- 1 = Rare event (e.g., Foreign Object Retained After Surgery)
- 2 = Some patients in hospital affected (e.g., ICU Physician Staffing)
- 3 = All patients in hospital affected (e.g., Hand Hygiene Safe Practice)

The *severity of harm* score is determined by the following:

- 1 = No direct evidence of harm or harm reduction (e.g., Hand Hygiene Safe Practice)

- 2 = Clear documentation of harm or harm reduction; adverse events (e.g., Foreign Object Retained After Surgery)
- 3 = Significant mortality reduction (more than 1,000 deaths or a 10% reduction in hospital wide mortality) (e.g., ICU Physician Staffing)

The values from each part are then added together to arrive at the overall Impact Score using the following criteria:

- 1 = Score of 2 (Low Impact)
- 2 = Score of 3-4 (Medium Impact) (e.g., Foreign Object Retained After Surgery; Hand Hygiene Safe Practice)
- 3 = Score of 5-6 (High Impact) (e.g., ICU Physician Staffing)

Scoring Methodology

Once all data elements have been collected for a given hospital and all missing data have been scored appropriately, the Hospital Safety Score can be calculated using the methodology described below.

Calculating Z-Scores

Z-Scores are used to standardize data from individual measures with different scales. This allows for the comparison of individual scores from different types of data. For example, a raw score of 97% on SCIP-INF-1 cannot be compared to a CLABSI SIR rate of 0.87, as they are reported on different scales. Z-Scores can tell a hospital whether their score on a particular measure is above, below, or equal to the mean.

In the Scoring Methodology, a Z-Score is calculated for each measure that is applicable to a hospital. A Z-Score is calculated using a hospital's actual (raw) measure score, the national mean, and the standard deviation for that measure. The Z-Score for each measure is calculated using the following formulas:

- For Process/Structural Measures: $[\text{Hospital Score} - \text{Mean}] / \text{Standard Deviation}$
- For Outcome Measures: $[(\text{Mean} - \text{Hospital Score}) / \text{Standard Deviation}]$

The following table includes the national mean and standard deviation for each measure. These values are used to calculate your hospital's Z-Score using the formula's above.

Measure Name	Mean	Standard Deviation
Process and Structural Measures		
Computerized Physician Order Entry (CPOE)	11.138824439	24.896079267
Intensivist Physician Staffing (IPS)	17.526155187	33.208206329

Safe Practice 1: Leadership Structures and Systems	107.09557432	17.079862999
Safe Practice 2: Culture Measurement, Feedback and Intervention	16.672308559	5.2635500736
Safe Practice 3: Teamwork Training and Skill Building	31.000000000	11.091908748
Safe Practice 4: Identification and Mitigation of Risks and Hazards	106.28378378	22.895096448
Safe Practice 9: Nursing Workforce	86.202364865	21.491867905
Safe Practice 17: Medication Reconciliation	30.893277027	5.8429357577
Safe Practice 19: Hand Hygiene	26.652027027	5.5912514559
Safe Practice 23: Care of the Ventilated Patient	17.408934240	4.005830427
SCIP INF 1: Antibiotic within 1 Hour	97.030280751	5.1831132449
SCIP INF 2: Antibiotic Selection	97.24323603	4.3641112167
SCIP INF 3: Antibiotic Discontinued After 24 Hours	95.325818932	6.0341827677
SCIP INF 9: Catheter Removal	89.686071035	10.341408223
SCIP VTE 2: VTE Prophylaxis	92.877497627	8.120480354
Outcome Measures		
Foreign Object Retained	0.02311727	0.0676484035
Air Embolism	0.0012598039	0.0090733212
Pressure Ulcer – Stages 3 and 4	0.1181489442	0.2070956989
Falls and Trauma	0.5685554299	0.4665937682
CLABSI	0.5908400292	0.5898736942
PSI 4: Death Among Surgical Inpatients	116.12359539	19.385806975
PSI 6: Iatrogenic Pneumothorax	0.3883069382	0.1566076364
PSI 11: Postoperative Respiratory Failure	10.178788599	3.7760031514
PSI 12: Postoperative PE/DVT	5.4460444947	2.711292451
PSI 14: Postoperative Wound Dehiscence	2.158336	0.4133506679
PSI 15: Accidental Puncture or Laceration	1.9735331825	0.9027987403

Calculating Weighted Measure Scores

Weighted Process Score. To find the weighted process score, first multiply the Z-Score of each process measure by the weight assigned for that measure to get the weighted process measure score. (Remember, if your hospital was not applicable on other process measures, your

hospital's weight on any given process or structural measure may differ from the standard weight.) Then, find the total process score by adding the weighted process measure scores of each process measure together. This is your hospital's overall weighted process score.

Weighted Outcome Score. To find the weighted outcome score, first multiply the Z-Score of each outcome measure by the weight assigned to that measure to get the weighted outcome measure score. (Remember, if your hospital was not applicable on other outcome measures, your hospital's weight on any given measure may differ from the standard weight.) Then, find the total outcome score by adding the weighted outcome measure scores of each outcome measure together. This is your hospital's overall weighted outcome score.

Calculating Overall Patient Safety Score

To calculate the overall Hospital Safety Score for your hospital, add the overall weighted process score and the overall weighted outcome score calculated in the previous step. Add "3" to your score; this is done to normalize scores to a positive distribution. This is your final Hospital Safety Score.

Appendix A. Scoring Worksheet

Measure Category	Overall Category Weight	Measure	Your Hospital's Score	Mean	Standard Deviation	Your Hospital's Z-Score	Standard Weight	Your Weight	Weighted Measure Score
Process/Structural	50%	CPOE		11.138824439	24.896079267		7.7%		
		IPS		17.526155187	33.208206329		7.5%		
		SP 1		107.09557432	17.079862999		2.3%		
		SP 2		16.672308559	5.2635500736		2.5%		
		SP 3		31.000000000	11.091908748		2.6%		
		SP 4		106.28378378	22.895096448		2.4%		
		SP 9		86.202364865	21.491867905		3.3%		
		SP 17		30.893277027	5.8429357577		2.4%		
		SP 19		26.652027027	5.5912514559		3.1%		
		SP 23		17.408934240	4.005830427		2.4%		
		SCIP-INF-1		97.030280751	5.1831132449		2.9%		
		SCIP-INF-2		97.24323603	4.3641112167		2.2%		
		SCIP-INF-3		95.325818932	6.0341827677		2.2%		
		SCIP-INF-9		89.686071035	10.341408223		3.0%		
		SCIP-VTE-2		92.877497627	8.120480354		3.7%		
Outcome	50%	HAC: Foreign Object Retained		0.02311727	0.0676484035		5.6%		
		HAC: Air Embolism		0.0012598039	0.0090733212		5.6%		
		HAC: Pressure Ulcers		0.1181489442	0.2070956989		7.4%		
		HAC: Falls and Trauma		0.5685554299	0.4665937682		6.0%		
		CLABSI		0.5908400292	0.5898736942		6.4%		

		PSI 4		116.12359539	19.385806975		2.7%		
		PSI 6		0.3883069382	0.1566076364		3.1%		
		PSI 11		10.178788599	3.7760031514		3.0%		
		PSI 12		5.4460444947	2.711292451		3.2%		
		PSI 14		2.158336	0.4133506679		2.7%		
		PSI 15		1.9735331825	0.9027987403		4.3%		
Process Measure Score (Sum of all Process/Structural Measures):									
Outcome Measure Score (Sum of all Outcome Measures):									
Final Safety Score Composite: (Process Score + Outcome Score):									

Appendix B. Hospital Safety Score Measures and Weights

Measure Category	Overall Category Weight	Measure	Evidence Score	Opportunity Score	Impact Score	Measure Weight
Process/Structural	50%	CPOE	2	3	3	7.7%
		IPS	2	2.894779886	3	7.5%
		SP 1	1	1.159482435	2	2.3%
		SP 2	1	1.315706134	2	2.5%
		SP 3	1	1.357803508	2	2.6%
		SP 4	1	1.215414766	2	2.4%
		SP 9	1	1.249318774	3	3.3%
		SP 17	1	1.189132922	2	2.4%
		SP 19	2	1.2097871	2	3.1%
		SP 23	1	1.230101991	2	2.4%
		SCIP-INF-1	2	1.053417482	2	2.9%
		SCIP-INF-2	1	1.044878301	2	2.2%
		SCIP-INF-3	1	1.063300613	2	2.2%
		SCIP-INF-9	2	1.115306737	2	3.0%
		SCIP-VTE-2	2	1.087432161	3	3.7%
Outcome	50%	HAC: Foreign Object Retained	1	3	2	5.6%
		HAC: Air Embolism	1	3	2	5.6%
		HAC: Pressure Ulcers	1	2.752835798	3	7.4%
		HAC: Falls and Trauma	2	1.820665398	3	6.0%
		CLABSI	2	1.998364473	3	6.4%
		PSI 4	1	1.166941154	2	2.7%
		PSI 6	1	1.40330888	2	3.1%
		PSI 11	1	1.370967833	2	3.0%
		PSI 12	1	1.497846181	2	3.2%
		PSI 14	1	1.191513586	2	2.7%
		PSI 15	1	1.457453033	3	4.3%

Safety Score Help Desk

If you have any questions regarding the scoring methodology, please contact the Help Desk at ScoreHelp@leapfroggroup.org.